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Case Report

Intrauterine fetal death caused by seatbelt injury

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ABSTRACT

Objective: Severe motor vehicle accidents involving pregnant women can result in fetal and neonatal death. We describe a case in which fetal death occurred due to relatively mild seatbelt injuries and present the characteristic magnetic resonance imaging (MRI) findings of the placenta.
Case Report: A 26-year-old primigravid woman at 20 weeks gestation was involved in an automobile accident. Although she suffered only a seatbelt injury, fetal death subsequently occurred. Contrast-enhanced MRI showed the region compressed by the seatbelt as a low-intensity band without enhancement, and serum alpha-fetoprotein and hemoglobin F levels were elevated.
Conclusion: Careful monitoring, including blood and abdominal examinations, should be performed when pregnant women suffer seatbelt injuries.

Introduction

Pregnant women in the second trimester have a higher risk of being in a serious motor vehicle crash (MVC) compared to that of pregnant women in the first or third trimester or non-pregnant women [1], and serious MVCs during pregnancy can result in fetal and neonatal deaths [2]. The incidence of fetal and neonatal death related to MVCs during pregnancy is at least 3.7 per 100,000 pregnancies [3]. Fetal death is more likely in cases involving direct fetoplacental injury, maternal shock, pelvic fracture, maternal injury, or hypoxia, and the chances of fetal death generally increase with the severity of maternal injuries [4]. We describe a case of intrauterine fetal death causally related to seatbelt injury without severe maternal injury and present the characteristic magnetic resonance imaging (MRI) findings of the placenta. We also describe the blood examinations that should be performed when pregnant women suffer seatbelt injuries.

Case presentation

A 26-year-old primigravid woman at 20 weeks gestation hit an oncoming car while traveling at a speed of 50 km/h, and her car rolled over. She was wearing a three-point seatbelt, and the airbag deployed. She was transported to our hospital by ambulance one hour after the accident. Her vital signs were within normal ranges, and she suffered only a seatbelt injury to her right shoulder and both anterior and superior iliac spines. She did not present with lower abdominal pain, uterine contractions, genital bleeding, or membrane rupture. Transabdominal ultrasonography indicated fetal bradycardia of 50–60 beats per minute, and fetal death was diagnosed 90 min after the accident. Blood tests revealed blood coagulopathy and fetomaternal hemorrhage, indicated by the following findings: D-dimer, 12.8 mcg/mL (normal <1 mcg/mL); fibrinogen degradation product (FDP), 24.4 mcg/mL (normal <10 mcg/mL); serum alpha-fetoprotein (AFP), 5934 ng/mL (normal during pregnancy <500 ng/mL); and hemoglobin F (HbF), 1.1% (normal <1.0%). Contrast-enhanced MRI performed to determine the cause of the intrauterine fetal death clearly showed the placental region compressed by the seatbelt appeared as a low-intensity band without enhancement (Fig. 1). These findings suggested placental ischemia and bleeding between the uterine myometrium and placenta.

Labor was induced, and the patient delivered a deceased female baby weighing 340 g. The placenta was expelled several minutes after the baby was delivered. Macroscopically, the placenta was clearly separated into a white-tinged area and a wine-colored area. In the wine-colored area, the placenta was torn with dark small clots (Fig. 2A). In addition, marked ischemic changes were microscopically noted, especially in the wine-colored placental area (Fig. 2B). The autopsy showed a preterm stillborn baby with no injuries or structural anomalies.

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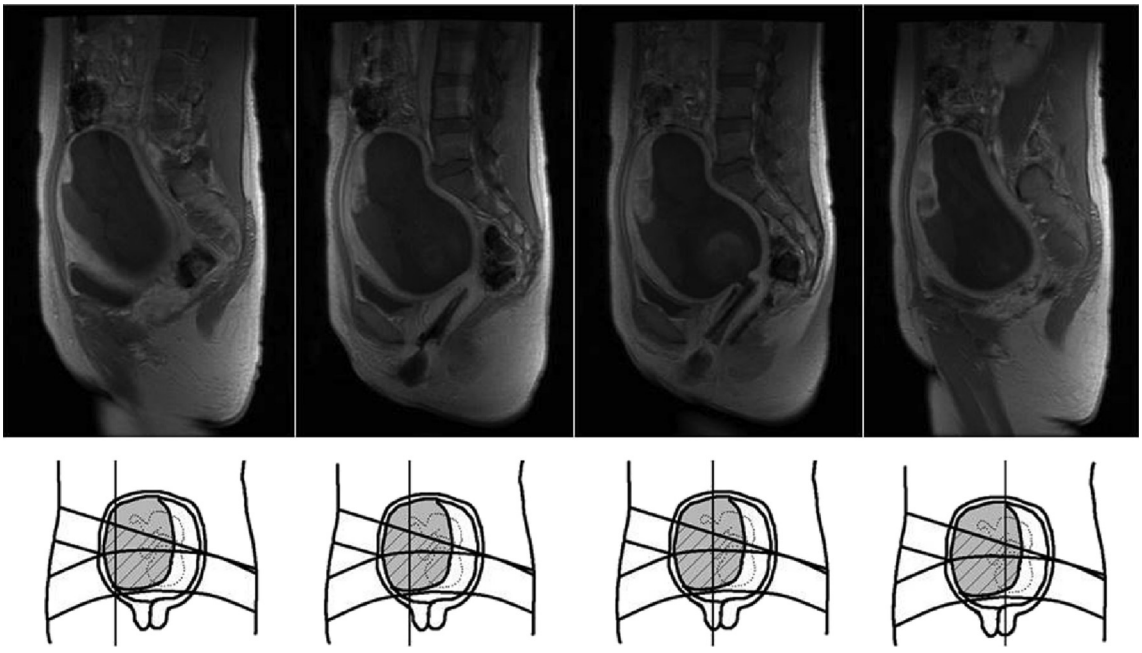

Fig. 1. Contrast-enhanced magnetic resonance imaging showing the placental region compressed by the seatbelt as a low-intensity band without enhancement.

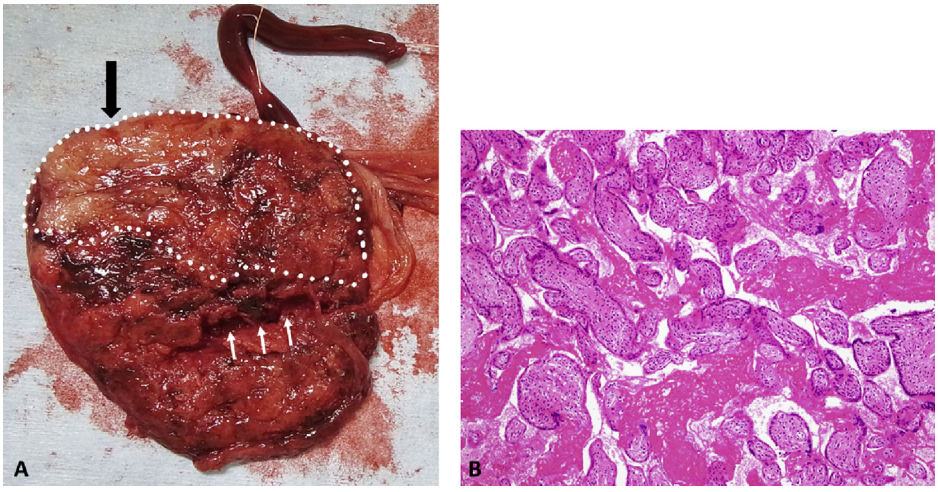

Fig. 2. (A) Macroscopically, the placenta was clearly separated into a white-tinged area (arrow) and a wine-colored area. Note the laceration of the placenta (small arrow) on the wine-colored area. (B) Microscopically, marked ischemic changes were noted, especially in the wine-colored placental area (H&E; 100×).

Discussion

Here, we have presented the characteristic MRI findings of a strip-shaped placental injury along the area compressed by a seatbelt. These MRI findings and the elevated AFP and HbF levels suggest fetal death was induced by placental ischemia and placental abruption due to seatbelt injury and by fetomaternal hemorrhage due to intraplacental vascular damage. Previous research has indicated that airbag deployment is associated with placental abruption and fetal death [5]. Although it remains possible that the placenta was damaged by the inflating airbag, a direct abdominal contusion, or a shearing force on the placenta when the car rolled over, we presumed that the placenta was primarily damaged by a direct seatbelt injury, based on the MRI findings.

Traumatic placental abruptions tend to be unaccompanied by uterine pain or genital bleeding, in contrast to nontraumatic placental abruptions [6]. Alternatively, traumatic placenta abruptions often exist in combination with placental tears [4]. Therefore, fetomaternal hemorrhage may be more common with traumatic abruptions, because trophoblast disruptions can cause fetomaternal hemorrhage [7,8]. We recommend performing a blood coagulation test and measurements of serum AFP and HbF to identify traumatic placental abruption and fetomaternal hemorrhage in addition to abdominal imaging.

Fetal outcome is strongly associated with maternal injury according to research that has used the injury severity score [2,9]. A higher crash severity, defined as an estimated change in velocity or equivalent barrier speed of the case vehicle during the impact event of greater than 48 km/h, is associated with a higher risk of adverse maternal and fetal outcomes [2]. However, as in this MVC case, fetuses can receive severe injuries in utero even if maternal injuries are minor. Therefore, careful fetal monitoring is necessary for all pregnant

women involved in MVCs, even if the maternal injury is minor, because it is too difficult to fully predict the severity of fetal injury on the basis of the maternal injury severity [10]. Moreover, traumatic fetomaternal hemorrhage occurs more commonly in pregnant women with anteriorly located placentas [11]. Therefore, careful monitoring is necessary, especially of women with anteriorly located placentas, even if the fetal heartbeat is normal and the pregnant woman has no uterine contractions upon the initial examination.

Seatbelt use has reduced the overall mortality associated with MVCs. Pregnant women who did not wear a seatbelt during an MVC were 7.1 times more likely to experience fetal death than women who wore a seatbelt during a crash [5]. Approximately half of fetal losses in MVCs could be prevented if all pregnant women "properly" wore seatbelts [2]. The National Highway Transportation Safety Administration recommends that pregnant women wear their seatbelts with the shoulder harness portion positioned over the collarbone between the women's breasts, and the lap belt portion as low as possible under the pregnant abdomen, on the hips and across the upper thighs rather than above or over the abdomen [12]. In our case, owing to the seatbelt and airbag system, the pregnant woman could have escaped with a minor injury in the face of a rollover accident. However, an inappropriate seatbelt position unfortunately induced intrauterine fetal death. It should be noted that seatbelts can be easily placed across the maternal abdominal dome because the uterus is relatively small during the first and second trimesters. Therefore, pregnant women should always take care of the seatbelt position when they are in an automobile. Education on "proper" seatbelt position and the use of an assistive device for seatbelt positioning should be a standard component of all prenatal care programs.

To the best of our knowledge, this is the first report to present serial contrast-enhanced magnetic resonance images of placental damage along the area compressed by a seatbelt. The presence of a seatbelt indication suggests an increased likelihood of abdominal and intestinal injuries [13]. Therefore, careful monitoring (e.g., fetal monitoring and blood tests, including clotting test, HbF, and AFP), in addition to abdominal examinations, should be performed when a pregnant women suffers seatbelt injuries.

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Conflicts of interest statement

The authors declare that they have no competing interests.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.tjog.2016.08.009.

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